Nova Scotia
Research Foundation
Corporation

Annual Report
1982-83

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The Research Foundation was established in 1946 by the Province of Nova Scotia to assist in the province's economic development. In 1975 a new Act changed the name to the Nova Scotia Research Foundation Corporation and stated the objective of the Corporation was to "assist in the economic development of Nova Scotia by promoting, stimulating, and encouraging the effective utilization of science and technology by industry and government." This change recognized the industrial orientation of the Corporation and the fact that approximately two-thirds of the Corporation's income is derived from contract Research and Development activities.

The Corporation, wholly owned by the Province of Nova Scotia, is controlled by a Board of Directors representing Nova Scotia's industrial, scientific and educational communities. The senior officers of the Corporation are Dr. J. E. Blanchard, President and Chief Executive Officer, and Mr. T.B. Nickerson, Vice-President and Secretary-Treasurer. The Corporation has a full time staff of 120 scientists, engineers, technicians and support staff occupying a well-equipped 5,670 square metre laboratory building and a 560 square metre pilot plant on its four-hectare Dartmouth site.

Five operating divisions — Industrial and Information Services, Chemistry, Biology, Geophysics and Engineering Physics/Centre For Ocean Technology — carry out approximately 2,000 projects each year for 500 companies and government departments. Projects range from providing information to help a company solve an immediate technical problem to carrying out research and development projects related to new industrial opportunities. The Corporation's activities can be grouped into two approximately equal parts — assisting industry in the solution of today's technical problems and developing new products/processes in response to tomorrow's opportunities. While the Corporation uses its capabilities to serve all sectors of Nova Scotia's industrial economy, particular emphasis is placed on technological support for the secondary manufacturing industry. The Corporation continues to emphasize the potential for ocean industry development in Nova Scotia.

The Corporation has assets of $7.2 million, including four million in buildings and equipment (valued at cost). Revenues for 1982/83 were $5.3 million. Although down from 1981/82, this figure represents an average compound growth of 16.2 percent annually over the past decade. Contract Research and Development contributed 62 percent of total income; investment income, four percent; and a grant from the Province of Nova Scotia, 34 percent. The grant is used to maintain a competent staff who monitor new technological developments which may be of particular relevance to Nova Scotia and who assist small companies unable to afford needed technological support.

Board of Directors

* **Dr. J. E. Blanchard**
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President
Nova Scotia Research
Foundation Corporation

Mr. P. Ferguson
Operations Manager
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Dartmouth,
Nova Scotia

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President and
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Halifax, Nova Scotia

Mr. J. C. Callaghan
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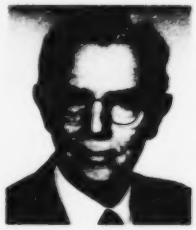

* **Dr. W.L. Ford**
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President and
General Manager
Chairman,
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Mr. T. B. Nickerson
Vice-President
Nova Scotia Research
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*Members of Executive Committee
of the Board of Directors.

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Honourable Roland J. Thornhill
Minister of Development
Province of Nova Scotia
Halifax, Nova Scotia

Sir:

I have the honour to submit the thirty-sixth Annual Report of the Nova Scotia Research Foundation Corporation.

Respectfully Submitted,

J. E. Blanchard

J. E. Blanchard
President

Dartmouth, Nova Scotia
November 1, 1983

President's Report

The role of the Nova Scotia Research Foundation Corporation, to utilize science and technology in support of economic development, takes on increased significance as we emerge from a severe recession and enter an era when technology will increasingly be the principal engine of economic growth. The Corporation is preparing to meet this challenge.

The recession has had a major impact on the Corporation during the past year. Contract research and development (R&D) revenue decreased as both industry and governments adjusted to the economic situation. The Corporation has been able, through careful management, to maintain services and at the same time achieve a close balance between revenue and expense. This would not have been possible without the cooperation of a dedicated staff.

Sales of the ocean hardware developed by the Corporation increased over previous years. The market for our electrical slip rings has broadened to include use in remotely controlled underwater vehicles, underwater trenchers and underwater pile drivers, in addition to their application in diving systems. The subcontracting of component part manufacture for the Corporation's ocean hardware generates significant economic benefit for a variety of Nova Scotia industries. At the year end the Corporation's Centre For Ocean Technology signed two major contracts for the development and installation of hyperbaric water and gas conditioning systems for Canadian diving research establishments. These contracts will generate additional subcontract work for Nova Scotia companies. Sales of magnetically coupled blowers and pumps by our wholly owned subsidiary, Nova Magnetics Limited, were less than forecast. This disappointment was balanced in part by penetration into the chemical and nuclear markets with our products.

The development of offshore oil and gas is the rising star on Nova Scotia's industrial horizon. The Corporation, with more than a decade of experience in the development of hardware for offshore oil and gas activities, looks forward to the new opportunities being generated by Scotian Shelf activity. One important technical area associated with offshore exploration and development is the performance of materials in the marine environment. The Corporation is currently expanding its materials R&D activity to provide the needed technological support.

While there are significant growth potentials for the Corporation, our limited financial resources have necessitated careful evaluation and in some instances a withdrawal from areas where other organizations are providing the necessary services for Nova Scotia industry. The number of organizations undertaking R&D in food chemistry in Nova Scotia has increased in recent years. The Technical University of Nova Scotia (TUNS) has received a substantial grant from the Canada Department of Industry, Trade and Commerce to support a Canadian Institute of Fisheries Technology. The expansion of the Agriculture Canada Research Station in Kentville provides extensive space for food science. There has also been a growth of food science R&D capability in the private sector. In view of our limited resources and our policy of not duplicating the work of others, the food chemistry activities of the Corporation have been terminated.

In previous Annual Reports the importance of small business to the economic well-being of Nova Scotia has been emphasized. Support of small business continues to be a major thrust of the Corporation. The products the Corporation has successfully brought through the innovation process have been demonstrated to be eminently suited for manufacture by Nova Scotia's small industries. During the past year licensing arrangements were completed for the manufacture of the Corporation's arsenic filter system by a local company. The National Research Council's Industrial Research Assistance Program (IRAP), operated under contract in Nova Scotia by the Corporation, responds to the many and varied technical information and industrial productivity needs of industry. Last year through the NRC program 2,300 technical inquiries from Nova Scotia industry were processed and 100 industrial productivity studies were completed. To assist industry in understanding and utilizing the latest developments in microelectronics NSRFC has established, in cooperation with the Technical University of Nova Scotia and Dalhousie University, the Applied Microelectronics Institute (AMI). With funding support from the Canada Department of Industry, Trade and Commerce, AMI will maintain a state of the art competence in microelectronics and use this competence to assist industry in applying this technology to improve existing processes and to create new products.

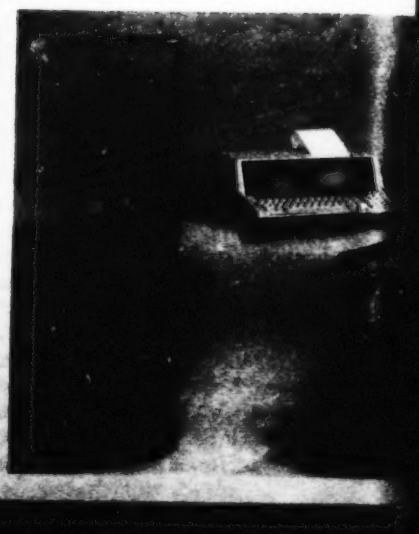
In our changing world it is clear that the future rests with those who have the desire and the capability to innovate. The innovation process is influenced by many factors. For some years we have suggested that the tax system has a major effect on innovation. People and business are motivated by the prospect of profitability. As long as Canada's tax structure favoured real estate and resource industries, money was not readily available for investment in technological innovation. It is pleasing to note that in a recent position paper the Federal Minister of Finance advocates that business and individual corporate investors in R&D receive tax benefits comparable to those now available to investors in other industries. This change, together with the growth of venture capital companies developing as a result of Nova Scotia's venture capital legislation, should provide considerable financial support for the innovation process. It is also encouraging to note that innovation continues to be one of the major components of the provincial government's industrial policy.

The present economic recession has resulted in more business failures and more unemployed people than any recession since the 1930's. As we move out of the recession there is a widespread concern that tomorrow's economy will not provide the same employment opportunities as in the previous decade. Microelectronics, robotics and other technology advances will have a major impact. Productivity in Nova Scotia's manufacturing industries will have to keep pace with our competitors or our industries will fail. It is also clear that Nova Scotia must constantly strive to increase the number and the size of companies engaged in manufacturing. Manufacturing, together with resource harvesting and processing, represent the principal wealth-generating capacity of Nova Scotia. This capacity must be increased. The R&D needs associated with these industries during the 1980's and beyond represents a considerable challenge for the Corporation.

Recognizing the rapidly changing nature of the industrial scene the Corporation, utilizing the many man - years of experience available through our Board of Directors, staff, and other sources, has begun the development of a five-year plan to identify specific R&D needs of industry and to plan how these needs can best be met.

People and Products

Hydrophone Array



Twenty-Five Years Service Presentation

Industrial and Information Services

The Industrial and Information Services Division provides, without charge, technical information and assistance to small manufacturing industries under the National Research Council (NRC) Industrial Research Assistance Program (IRAP) and technical information under the Energy Test and Information Centre (ENERTIC) program of the federal and provincial energy departments. The Division performs contract work on technical, marketing, and operational research problems and administers the Corporation's technical Library.

Research and Development

The IRAP Field Advisory Service and the Operational Research section are continuing to encourage the use of microcomputers by small business. A microcomputer has been acquired to aid in the selection of systems and programs suitable for these businesses.

Problem Solving

IRAP-C (Field Advisory Service)
This program assists small industry in solving technical problems and in adapting new and improved methods. IRAP-C is divided into three parts - technical inquiries, industrial engineering, and programs.

- **Technical Inquiries** (Dartmouth and Sydney Offices)

The staff consists of three engineers and a technician. During the year 2,331 inquiries resulted from 2,131 contacts. There were 447 field calls.
Typical Inquiries: location of suppliers for special materials, standards, woodworking machinery, patents, plastics, and fibreglass.

- **Industrial Engineering**

This section assists companies to increase productivity through the use of new and improved methods. Typically, an engineer works for a client to assist in solving a particular problem. The most common form of assistance is plant layouts. Three engineers undertook 96 projects during the year.

- **Programs**

An engineer assists industries in applying for NRC's IRAP-H, -L,-M, and P programs. Approvals were received for 22 IRAP projects by the end of the fiscal year. The Student Program placed 17 students in 17 industries.

Contract Services
This section includes Project Services and Operational Research.

- **Project Services**

At the end of the fiscal year, the Ener$ave Consulting Follow-Up Program reverted to the Nova Scotia Department of Mines and Energy. The Information Service of ENERTIC answered 224 inquiries during the year. ENERTIC consists of an Information Centre at NSRFC and a Test Centre located at the Technical University of Nova Scotia.
Project Services contract activities included: a coal literature survey; assistance on a Canadian International Development Agency (CIDA) contract for agricultural equipment development and testing in Brazil; marketing feasibility studies on: vitamins; cod liver oil; and water treatment products; and a study into business opportunities for an existing organization.

- **Operational Research**

Mathematical modelling was used by the staff in the completion of the following studies: a fishing vessel information system, improvement of the ENERTIC Information System, a diver data acquisition system, internal programs for Administration, and a school bus routing problem.

Technical Library
The Library is an essential resource for all Corporation staff. Excellent co-operation exists between the Corporation Library and other technical and scientific libraries in Nova Scotia. Use is made of online data base searching, in addition to normal literature searches and use of Library books and journals.

Services

IRAP-C Field Advisory Service
Technical Inquiries
Assistance to industry in identifying and solving problems relating to materials, processes, and equipment by using the available technical literature, assistance in its interpretation, and adaptation to the problem.

IRAP-C Field Advisory Service
Industrial Engineering
Assistance to small, secondary manufacturers in the diagnosis and solution of plant problems using economic, operational, and statistical analyses. Assistance in implementing improved methods, controls, and procedures.

IRAP-C Programs
Advice is provided to companies in accessing NRC programs. Assistance is furnished to develop the project and prepare program applications.

Feasibility Studies
Industrial feasibility studies consisting of technical, economic, and market analyses related to specific industrial opportunities.

Optimal Allocation Problems
Solution to scheduling, routing, blending, and mixing problems, using mathematical models.

ENERTIC Information System
In-depth technical literature and material in response to specific inquiries.

Technical Studies
Industrial Engineering and Marketing studies to solve specific problems and investigate business opportunities.

Information Reporting Systems
Design and implementation of manual and computer-based information and reporting systems.

Library Services
Availability of 11,000 books, periodicals, and pamphlets on scientific and technical subjects. Literature searches on technical subjects, both manually and by computer.

Staff

Director
J. R. Helliwell
A.C.S.M. (Camborne), P.Eng.

Professional
IRAP-C Field Advisory Service
J. P. Archibald
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D. W. Martell
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R. S. McVittie
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Ph.D.(U.B.C.), P.Ag., P.Eng.
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Operational Research
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B.S.A. (Acadia)
H. A. Kornuta
B.A. (Concordia)
M. C. MacDonald
B.A. (Dal., King's)
M.W. Veling
B.Sc. (Dal.)

Secretarial
C. L. O'Connell
J. L. Stewart

* Project Leader

Geophysics Division

Marine Geophysics section includes Contract Survey and Manufacturing sections. Equipment and operators are available for contract surveys and there is expertise in the design, development, production, and sale of marine geophysical equipment for offshore scientific and engineering investigation. The Ground Geophysics section covers Contract Survey and Data Interpretation, with experience in data reduction, interpretation and development of techniques and equipment for Ground Geophysical Surveys. Equipment and operators are available for a variety of ground geophysical surveys.

Research and Development

A prototype sidescan sonar was successfully tested with the NSRFC Deep-Towed Sub-Bottom Profiling System. Good records were obtained with the equipment at ship speeds as high as eight knots. The system will be ready for further testing in the spring of 1983 with the objective of marketing the completed system for delivery early in 1984.

A preliminary field evaluation of a multi-channel digital engineering seismograph was conducted in the Dartmouth and Musquodoboit area with the objective of detecting and mapping shallow reflectors, including sand bodies and mined-out coal seams.

Additional gravity stations were established in the Stellarton-Thorburn and Sydney coal basins. New Bouguer gravity contour maps of the basins are being prepared, following processing and integration of the new gravity data with earlier work. The well-logging equipment has been extensively updated by the staff. The improvements are ready for field testing in the spring of 1983.

Problem Solving

The summer months were spent surveying offshore drill sites and delineating sand and gravel deposits in the Beaufort Sea for two major oil exploration companies. Other inshore marine seismic surveys were made for the National Research Council at locations in Prince Edward Island and New Brunswick and for the Bedford Institute of Oceanography in the vicinity of Sable Island.

Geophysical bore-hole logging for the province's coal exploration program was undertaken at locations near Springhill and in Cape Breton Island.

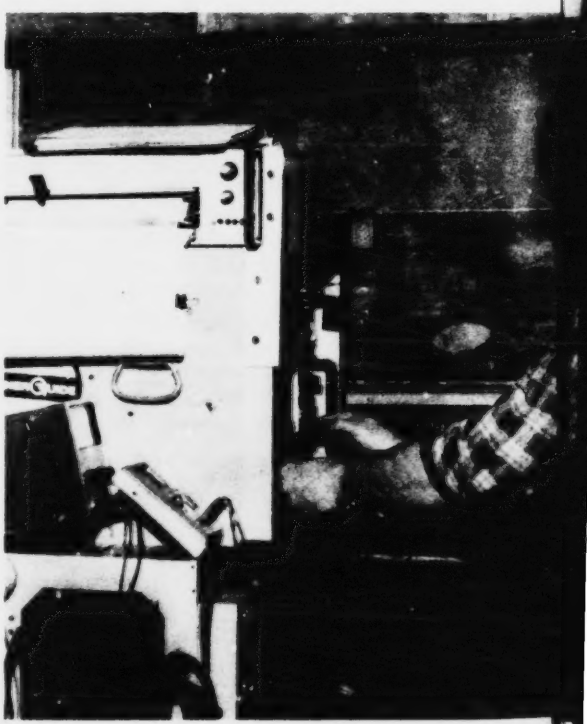
Data Interpretation of shallow water marine seismic surveys was carried out for the National Research Council. Our gravity data was purchased by several mineral exploration companies.

Equipment Sales

Marketing and sales promotion by members of the Geophysics Division supplemented the work of the NSRFC Marketing Group by attending exhibitions and conferences in Houston and Dallas, U.S.A.; and in Stavanger, Norway. In addition, Geophysical and Scientific Equipment Limited of England was appointed sales agents for NSRFC Marine Geophysical Equipment to improve sales in Europe.

Products include:
Deep-Tow Bottom Profiling System
Shallow-Tow Bottom Profiling System
High Resolution Seismic Hydrophone Arrays
Winch Cable Footage Counters

Sale of spare parts for NSRFC systems are contributing to divisional revenues.



Services

Bore-Hole Logging
Measurements of spontaneous potential, resistance, hole diameter, dip and azimuth, and scattered gamma (density) and total natural gamma radiation, including bed resolution capability for coal-seam logging, to depths of 2,000 metres.

Sub-Bottom Profiling
High resolution, deep- and shallow-towed sub-bottom seismic profiling surveys in water depths from one metre to 1,000 metres for drilling rig site surveys, pipeline routes, iceberg scours, pockmarks, regional surficial sediment surveys, dredging surveys, cable crossings, harbour facilities, outfall pipes, tanker terminals, etc. Sidescan sonar and depth sounder surveys to complement sub-bottom profiling.

Mineral Surveys
Gravity, magnetic, induced polarization, electromagnetic, resistivity, shallow seismic and bore-hole logging surveys used in the search for salt, potash, uranium, coal, celestite, barite, gypsum, base metals and other minerals.

Land Seismics
Seismic surveys to determine depth to bedrock and nature of overlying material for civil engineering studies on proposed dam sites, waste disposal sites, gravel deposits, etc.

Maps
Tectonic, drainage, Bouguer gravity, and topographic maps of Nova Scotia on various scales.

Staff

Director
D. E. T. Bidgood
B.A., M.A., Ph.D. (Cantab.)

Professional
Marine Geophysics
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Chief Ground Geophysicist
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F. M. Smith
L. G. Tufts

Secretarial
G. P. Woodgate

Engineering Physics and the Centre for Ocean Technology

The electronic and mechanical engineering design skills of the Division are used to support and encourage the development of specialized industrial hardware suitable for manufacture in Nova Scotia and competitive in world markets. The Centre For Ocean Technology, which was originally funded in part by the Federal Department of Industry, Trade and Commerce, emphasizes development of ocean hardware.

Research and Development

New Electrical Slip Rings
The commercial success of the NSRFC Type 119 electrical slip ring, widely used by the commercial diving and remote control underwater vehicle industry, has resulted in further development contracts for the Division. The new products developed by the Division include:

- **Higher - Power Electrical Slip Ring**
Developed to meet the needs of very large marine and underwater systems, this slip ring is capable of handling high voltage - high current electrical power in excess of 2 megawatts. The demand for these high power levels has increased as offshore underwater systems become larger and more powerful. The first application for our new ultra-high-power electrical slip ring was on an underwater trencher developed in the British Isles to assist in the laying of the England-France cross-Channel power-sharing cable.

- **Seismic Streamer Electrical Slip Ring**
Developed to meet the needs of modern seismic surveying vessels, this slip ring will handle up to 500 circuits and finds application on seismic streamer winches. The first application of this unit is on a new seismic vessel, being built for Canadian use.

- **Air Gun Slip Ring**
Modern marine seismic systems use, as an energy source, complex air gun arrays which are towed behind seismic survey vessels. These arrays are supplied with air from high pressure compressors and are deployed from winches mounted near the stern. Handling safety and operation of these air gun arrays are improved through the use of air gun slip rings mounted in the winch.

The Division has successfully combined its fluid rotary union and electrical slip ring technology to produce combined units capable of handling high pressure air (up to 500psi) and the multiple electrical conductor requirements for the control of modern air gun systems.

Hyperbaric Atmospheric and Water Conditioning Systems
The development of NSRFC hyperbaric blowers has given the Division a major opportunity to supply complete environmental conditioning systems incorporating our patented magnetic drives. The Division has obtained two major contracts to supply these systems to the Defence and Civil Institute of Environmental Medicine (D.C.I.E.M.) in Toronto and Simon Fraser University in British Columbia. These contracts represent work for Nova Scotia companies who are subcontractors to NSRFC.

Fishing Technology
The Division has a research contract with the Federal Department of Fisheries and Oceans to determine the response of scallops to various stimuli. The results of this work may lead to Canadian patents concerned with new fishing methods for scallops. This research activity has been a co-operative venture of this Division, our Biology Division, and Federal Fisheries and Oceans.

Problem Solving

The Division used its ocean-related electronic and mechanical engineering skills to assist industry and individuals in a variety of problems. Services included assistance to inventors relating to patent applications, industrial design services, and provision for specialized industrial measurements.

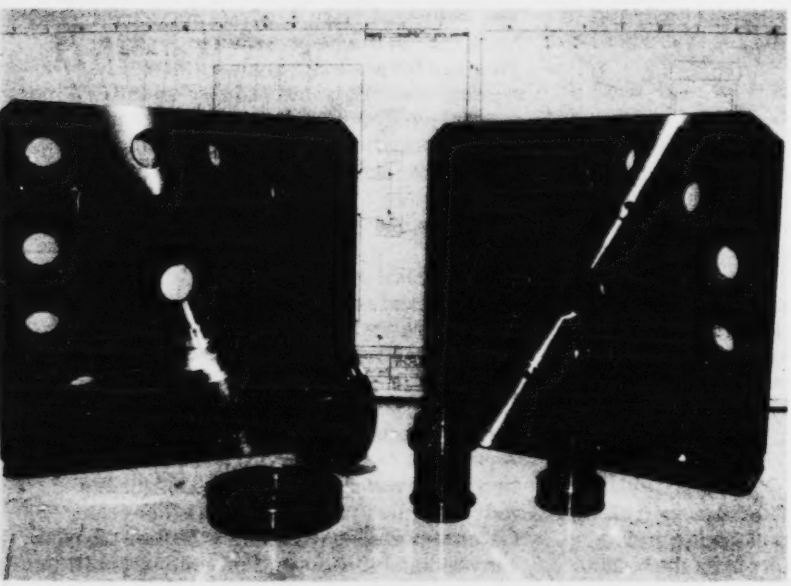
Services

Advisory Services
Engineering services to industry on matters concerning equipment operating in a marine environment.

Engineering Support
Design team service on a subcontract basis to enhance prime contractor engineering capabilities.

Product Development
Ocean-oriented product design and development on a contract, royalty or venture engineering basis. Development or modification of instruments to meet measurement needs in fields of biology, chemistry, geophysics, and oceanography.

Industrial Measurement
The Division provides measurement capability for a variety of physical parameters. Indoor lighting environment surveys covering both intensity and spectrum. Transmission measurement of translucent materials. Noise surveys, indoor and outdoor. Recording and spectral correlation analysis of sounds. Technical assistance with community and industrial noise problems. Services include instrument rentals, field measurements, and data analysis.



Hyperbaric Blower Parts

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B.Sc. (Dal.)
R. Warnell

Secretarial
S. Williams

Chemistry Division

The Chemistry Division undertakes chemical and chemical engineering research and development and problem solving for industry and government in Nova Scotia in response to existing problems and future opportunities. Process innovation and product improvement related to the utilization of the Province's natural resources form a major part of the work of the Division.

Research and Development

Arsenic Removal Equipment
Equipment developed for the removal of arsenic from well waters was licensed for manufacture to a local firm. An on-site method of measuring arsenic is being investigated.

Methane Measurement
A theoretical review of possible methods for the remote detection of methane gas in the atmosphere of coal mines was completed. Analytical techniques using electromagnetic radiation show the most promise.

Coal Liquefaction
A number of improvements were made to automate our pilot plant liquefaction unit. An intensive program of extraction runs was performed on Prince and Lingan coals of various ash contents utilizing a hydrogenated donar solvent. Future work will extend the range of Nova Scotia coals that are amenable to the liquefaction process.

Coal Pyrolysis
An initial experimental program on the pyrolysis of coal-lime mixtures was completed. The goal of producing a one percent sulphur char from high sulphur coal was attained. Approximately forty percent of the organic sulphur and in excess of ninety percent of the pyritic sulphur in the coal is retained in the char as calcium sulphide during pyrolysis. A water-hydrogen sulphide leach removes calcium sulphide from the char as calcium hydrosulphide. Work is underway to maximize coal liquid yields compatible with maintaining a low sulphur char.

Food Research
A quantity of chips made from deboned chicken meat was produced for panel testing and statistical evaluation. Results from the tests indicated that the product merited consideration as a snack food.

Corrosion
The program of corrosion studies on aluminum-silicon bronze was continued for the Defence Research Establishment (Atlantic). Heat-treatment was shown to be beneficial to protect these alloys from corrosion attack. Exposure of selectively heat-treated alloys to both simulated marine environments and to steam-condensate lines was investigated.

Ceramic Nozzle Components
Nozzle components of alumina were produced using a technique developed at the Atlantic Regional Laboratory(ARL) for making crucibles. The product showed promising mechanical and physical properties suitable for burner nozzle application. Work will continue to optimize this simple and inexpensive process.

Problem Solving

Industrial Trace Analysis Service
The Industrial Trace Analysis Service provides assistance to the heavy water industry of the Province for antifoam analyses as well as antifoam reactivity and stability under G-S process conditions. Progress was made in the application of ion chromatography to trace anion analysis. Trace organic analysis of public water systems was provided as identification of water quality.

Metallurgical Assistance
Metallurgical assistance, with particular emphasis on failure analysis, was expanded to provide a wider range of services to offshore industrial activities and to industry in general.

Gamma-Scanning
A gamma-scanning service was provided to the two heavy water plants in Nova Scotia but at a reduced scale in comparison to other years. Gamma-scanning overcomes the limitations of conventional sensors and provides accurate assessment of the hydraulic conditions on the trays inside operating towers. Gamma-scanning may find wider application in the petroleum and petrochemical industries.

Services

Analytical Services
Inorganic and organic analyses of gases, liquids, and solids using both classical and modern instrumental methods; organic compound identification by means of gas chromatography, liquid chromatography and infrared, ultraviolet and visible spectrophotometry; and analysis and identification of ores and metals utilizing atomic absorption, emission spectrograph and x-ray fluorescence and diffraction equipment.

Chemical Engineering
Cost analysis, process development, process feasibility, and engineering design as well as studies of coal liquefaction and sulphur removal from coal.

Corrosion Control
Identification and solution of industrial problems related to corrosion.

Effluents
Investigation into methods for reduction in Biological Oxygen Demand (BOD), suspended solids, colour, and toxicity in industrial waste waters.

Foliar Analysis
Determination of nutrient needs in fields and greenhouse crops by spectrochemical analysis of plant leaves.

Gamma Scanning
Gamma scanning of process towers, such as those in heavy water and other chemical plants, to determine liquid-vapour distribution inside operating towers. Towers up to 8.5 m (28 feet) in diameter and 90 mm (3.5 inches) wall thickness can be scanned using a 10-curie cobalt-60 gamma-ray source.

Industrial Chemistry
Chemical investigations to develop new processes for the greater utilization of natural resources and the development of new products for the resource-based industries of Nova Scotia.

Metallurgical Testing
Services available include:
(a) welder qualification tests
(b) weld performance qualification tests
(c) failure analysis
(d) mechanical testing of materials
(e) corrosion testing of materials

Spectrograph Services
Direct reader and photographic emission spectrograph for semi-quantitative analysis of metals, ores, corrosion products, foilage, fuel ash, etc.

Thermal Analysis
Utilizing the Stone DTA and TGA equipment, to evaluate endothermic and exothermic data caused by phase change or decomposition. Record weight losses versus temperature up to 1500°C.

Staff

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T. Betancourt
B.Eng. (S.V.S.T.), M.Eng. (T.U.N.S.), P.Eng.
A. Kazi
B.Sc.Eng. (Dacca), M.Eng. (McMaster) Ph.D. (T.U.N.S.), P.Eng.
M. L. Robicheau
B.Sc. (Dal.)
Coal Conversion
D. Jay
B.Sc. (Queen's), P.Eng.
J. K. LeDue
B.Sc. (Dal.)
J. J. Starzomski
B.Sc. (St. F.X.)
Gamma Scanning
B. Rapson
B.Sc., M.Sc. (Queen's), P.Eng.
Coal Desulphurization — Pyrolysis
A. L. Crandlemire
B.Sc. (Mt. A.)
N. Stover
B.Sc. (U.N.B.), M.E.Sc. (U.W.O.), P.Eng.
Heavy Water Plants
Analytical Services
J. W. Thorpe
B.Sc., M.Sc. (Acadia), Ph.D. (McMaster)

Technical
M. H. Bacon
H. F. Ballum
R. K. Boss
B.Sc. (Mt. A.)
W. E. Dearman
B.Sc. (Dal.)
L. D. Giffin
B.Sc. (S.M.U.)
W. R. Gillis
B.Sc. (S.M.U.)
K. L.Gunn
P. C. Malley
R. G. Mombourquette
R. E. Skinner
B.Sc. (Dal.)
J. E. Sponagle
B.Sc. (Dal.)
H. E. Stillman
B.Sc. (Dal.)
S. G. Thomas

Secretarial
S. R. Cash
B.E.M. (Civil)
B.Sc. (M.S.V.)

Biology Division

The Biology Division emphasizes research and development related to fermentation and microbial technology. The work of the Division includes the development of biological products and processes as well as the provision of biological services to industry and government.

Research and Development

Fermentation
The Division is interested in using fermentation methods to generate products of high value such as enzymes, biochemicals, foodstuffs, or animal feed. Previous projects of the Division included the production of new bacterial polysaccharides and the fungal fermentation of lignocellulosic materials, such as wood and straw, to produce a ruminant feed.

During the past year, work continued on the development of methods for the production of microbial lipase, an enzyme used in the determination of serum triglycerides for diagnostic purposes. Research focused on optimizing the fermentation conditions for maximum yield of the enzyme.

Mycorrhizal Fungi
Fungi associated with plant roots, forming so-called mycorrhizae, are known to be beneficial to forest trees as well as to agricultural crops. There is evidence that these symbiotic associations aid in the uptake of nutrients by the plant and in the protection against soil-borne diseases.

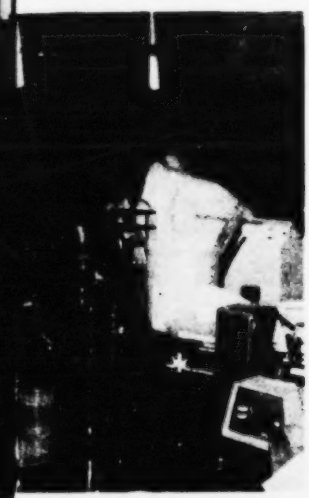
Under contract with Agricultural Canada, work was started to assess the potential of improving alfalfa yields by mycorrhizae inoculations. The first part of this work is concerned with the determination of the natural mycorrhizal colonization of alfalfa at various locations in the Province. In the second part, the effect of inoculation with various commercial and locally isolated mycorrhizae strains on alfalfa yields will be studied.

Bacteriological Water Quality
A bacteriological evaluation of domestic activated charcoal filters was conducted for Health and Welfare Canada. The investigation indicated that the use of such filters resulted in elevated bacterial counts.

A study was also undertaken to determine the best plate count methodology for chlorinated drinking water. Choice of media, incubation times and technique all significantly influenced the results.

Problem Solving

The Division provided services to an increasing number of local companies in the fields of food and water microbiology and aquatic toxicity. Fresh fish and shellfish, canned or frozen foods, beverages, bakery products, and confectionery were examined for the presence of pathogenic and non-pathogenic bacteria, yeasts, and mold. Bacterial examinations were conducted on water supplies and waste waters. A comprehensive study dealt with the possibility of bacterial contamination of domestic water filters. Various industrial effluents were tested for the presence of toxic materials, using rainbow trout as the standard bioassay organism.



Services

Food Microbiology
Quality control and analysis of foodstuffs, with respect to pathogenic and other micro-organisms. Testing for toxic metabolites such as aflatoxins or other mycotoxins produced by micro-organisms in food and feedstuffs.

Environmental Microbiology
Microbiological studies in freshwater, marine, and terrestial environments.

Fermentation Research
Investigation into the use of micro-organisms for the conversion of low-cost substrates or wastes into microbial biomass or useful metabolites.

Staff

Director
K. E. Hellenbrand
Ph.D. (Gottingen)

Professional
Fermentation, Food and Industrial Microbiology
A. E. Reade
B.Tech. (Brunel), Ph.D. (Aberdeen)
Plant Physiology, Plant-Microbe Interactions
C. D. Boyle
B.A., B.Sc. (Queen's), M.Sc. (Dal.)
Environmental Microbiology, Nitrogen Fixation
W. J. Robertson
B.Sc. (Dal.), (Dipl. Biochem., Algonquin)

Technical
J. E. Dickie
B.Sc. (Mt. A.)
C. L. Graham
B.Sc. (Mt. A.)
K. E. Spencer
B.Sc. (P.S.U.)

Secretarial
J. M. Colpitts

Marketing & Ocean Technology Production

Marketing

The Marketing Group has the twofold role of selling NSRFC products in the international marine market and identifying new applications for existing products and new products for existing markets. Sales and marketing were carried out by a variety of means including journal advertising; trade shows in Norway, the U.S.A. and Nova Scotia; and an increase in the network of representatives who sell products for and channel new ideas back to NSRFC. These representatives include:

Tamtech Limited (U.K. and Ireland)
Aberdeen, Scotland

MacArtney ApS (Scandinavia)
Esbjerg, Denmark

J. Bornhoft Industriegerate GmbH (Germany, Austria)
Kiel, West Germany

G.S.E. (U.K.)
Luton, England

I.N.A. (Holland)
Rotterdam, Holland

Nereides (France)
Paris, France

Stewart Engineering (New England)
Topsfield, Massachusetts

Techmation (Belgium, Luxembourg)
Brussels, Belgium

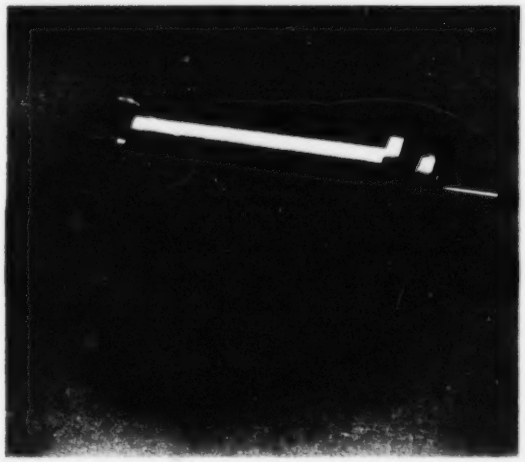
T. Thompson Limited (Western Canada)
Vancouver, British Columbia

The market for diving systems and remote control undersea vehicles continues to be satisfactory.

Head of Marketing
J. A. Gillis
B.Sc. (St. F.X.), B.Ed. (S.M.U.), MBA (Dal.)

Secretarial
J. P. Cranford

Ocean Technology Production



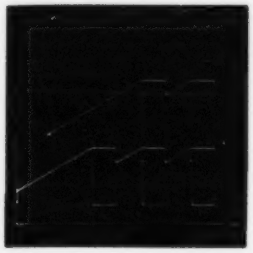
Seismic Air Gun Slip Ring

Ocean Technology Production (OTP) coordinates the assembly, testing, and quality control of the Nova Scotia Research Foundation Corporation's electrical slip ring and fluid rotary union products. Component manufacture for these products is contracted with local industry. Engineering and R&D are provided by the Corporation's Centre For Ocean Technology. Product marketing and sales are handled by the Corporation's Marketing Group.

Sales of electrical slip rings and fluid rotary unions, including new units developed by the Centre For Ocean Technology, increased over last year. The continued growth in the market for manned diving systems and remote control vehicles, and a wide network of representatives were the principal reasons for the sales increase. The Canadian portion doubled to ten percent of total sales. This reflected the increased activity of Canadian offshore oil and gas exploration.

Head of OTP
P.M. Baker

Nova Magnetics Limited



Nova Magnetics Limited (NML) completed its first full year of operation on March 31, 1983. NML sales consisted of limited quantities of magnetically coupled blowers of various designs. In addition to the hyperbaric blower using a centrifugal gas circulator, sales included regenerative and positive-displacement pumps. It is hoped that sales opportunities will expand the product line of the company to cover the three major market areas - chemical, nuclear, and deep diving. Organizational activity included the preparation of production and quality control systems to complement NSRFC procedures.

The Nova Magnetics Board of Directors are:
Dr. J. E. Blanchard
(President, NSRFC)
Mr. T. B. Nickerson
(Vice-President, NSRFC)
Mr. D. H. Covill
(President, Nautical Electronic Laboratories Limited)
Mr. D. H. McKeough
(Chairman of the Board, Ferguson Industries Limited)
Mr. P. M. Taiani
(Associate Research Officer, NSRFC)
Mr. C. R. Tyner
(Director of Engineering Physics Division, NSRFC)

The following Corporation personnel are the Officers of Nova Magnetics Limited:
Dr. J. E. Blanchard
(President)
Mr. C. R. Tyner
(Vice-President and General Manager)
Mr. J. A. Gillis
(Vice-President, Marketing)
Mr. T. B. Nickerson
(Vice-President, Finance)
Mr. R. F. MacNeill
(Secretary/Treasurer)

New Product Development

Applied Microelectronics Institute

The Applied Microelectronics Institute was incorporated in June of 1982 as a centre of excellence bringing together the major portion of the microelectronics research and development efforts of the Technical University of Nova Scotia, Dalhousie University and the Nova Scotia Research Foundation Corporation. Incorporated federally as a non-profit corporation, the Institute is managed by a Board of Directors drawn from industry, university, and government. NSRFC nominees to the Board are T. B. Nickerson (Chairman); G. A. Smith, Hermes Electronics Limited; and J. F. Maloney, Fisheries Resource Development Limited.

The Institute's objective is the development and maintenance of an outstanding technical competence in microelectronics with a view to encouraging growth of the industry in this region. Activities in achieving this objective may be divided into the areas summarized below.

Industrial Applications
Perform contractual research and development for industrial clients. Emphasis is placed on projects of an innovative nature.

Technology Transfer
Identify potential commercial products and, in collaboration with industry, develop the concept so that it may be manufactured commercially.

Industrial Training
Provide various short courses, workshops, and seminars on the latest electronic developments to managers and technical people.

Graduate Supervision
Provide facilities and supervision for graduate research.

NSRFC Staff Member
A. G. Jost
B.Sc., M.Sc., Ph.D. (Dal.)

Revenue Overview

Source of Revenue 1982/83

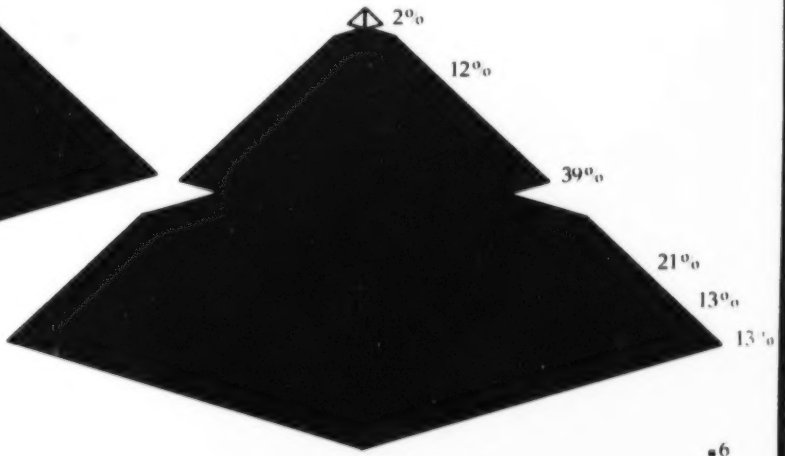
Contracts	62%
Grant — Province of N.S.	34%
Investment Income	4%

Source of Contracts 1982/83

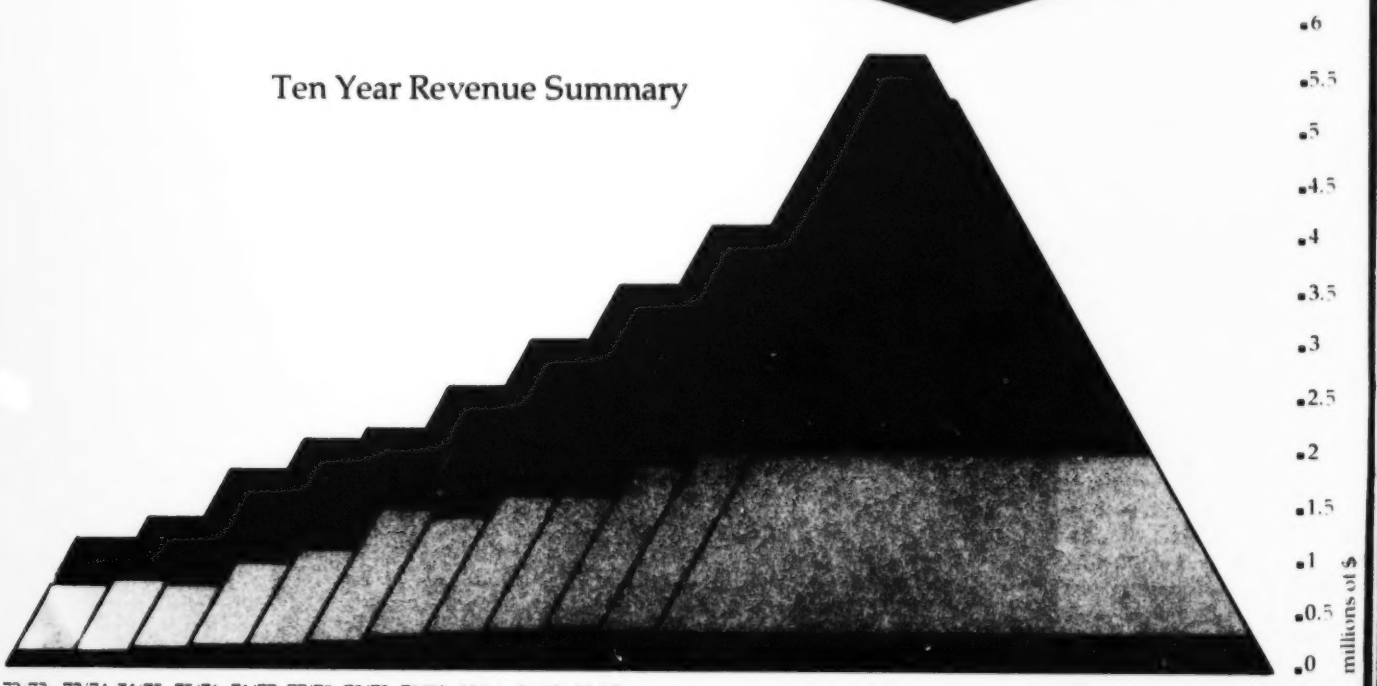
(by $ value)

Industry*		47%
Nova Scotia	13%	
Rest of Canada	13%	
Foreign	21%	
Government		51%
Federal	39%	
Nova Scotia	12%	
University		2%

*Includes Crown Corporations



Ten Year Revenue Summary



Auditor's Report

To the Chairman and Members of the
Board of Directors of the
Nova Scotia Research Foundation Corporation

I have examined the consolidated balance sheet of the Nova Scotia Research Foundation Corporation as at March 31, 1983 and the consolidated statements of revenues and expenses and retained earnings for the year then ended. My examination was made in accordance with generally accepted auditing standards, and accordingly included such tests and other procedures as I considered necessary in the circumstances.

In my opinion, these consolidated financial statements present fairly the financial position of the Corporation as at March 31, 1983 and the results of its operations for the year then ended, in accordance with generally accepted accounting principles, except for the method of accounting for fixed assets, as referred to in Note 1 to the financial statements, applied on a basis consistent with that of the preceding year.

A. W. Sarty
Auditor General
Halifax, Nova Scotia
June 25, 1983

Notes To The Consolidated Financial Statements For The Year Ended March 31, 1983

1. **Accounting Policies**

a) Principles of Consolidation

The consolidated financial statements include the accounts of Nova Magnetics Limited which is 100% owned by the Nova Scotia Research Foundation Corporation. The Corporation set up Nova Magnetics on May 1, 1981. The comparative figures for the year ended March 31, 1982 have been restated to reflect the consolidated results of operations for that period.

b) **Inventory**

Supplies are valued at the lower of cost and net realizable value.

c) **Fixed Assets and Contributed Surplus**

Fixed assets are acquired by purchase and by donation.

When fixed assets are acquired out of the general revenues of the Corporation, they are charged to expense in the year of acquisition.

For accounting purposes, the costs of all fixed asset additions, whether by purchase or donation, are recorded in the fixed asset account, with an offsetting credit to contributed surplus.

When fixed assets are constructed by the Corporation, the related material, labour and overhead costs are included as fixed assets in the year of expenditure.

When equipment is ten years old, the cost is removed from both the fixed asset and contributed surplus accounts.

2. **Capital Equipment Reserve**

In anticipation of capital equipment purchases, at significantly higher costs in future years, the Corporation has set up a Capital Equipment Reserve by appropriations from Retained Earnings. The balance of this reserve at March 31, 1983 was $111,038.

Financial Statement

Nova Scotia Research Foundation Corporation
Consolidated Balance Sheet as at March 31, 1983

Assets		1983	1982 Restated (Note 1A)
Current	Cash	$ 57,792	$ 109,496
	Accounts receivable (net of allowance for doubtful accounts, 1983-$3,170; 1982-$20,600)	1,213,399	908,431
	Short term investments	530,823	1,207,085
	Inventory (Note 1)	384,076	200,836
		2,186,090	2,425,848
Research Endowment Fund	Province of Nova Scotia 11% Promissory Note, payable November 25, 1983	1,000,000	1,000,000
Fixed (Note 1)	Land and buildings	2,843,267	2,843,267
	Equipment	1,156,412	1,296,122
		3,999,679	4,139,389
		$7,185,769	$7,565,237

Liabilities and Equity		1983	1982 Restated
Current	Accounts payable		
	Trade	$ 185,722	$ 339,391
	Province of Nova Scotia	991,794	1,112,393
	Deferred revenue	137,000	56,162
		1,314,516	1,507,946
Research Endowment Fund	Fund balance	1,000,000	1,000,000
Equity	Capital equipment reserve (Note 2)	111,038	111,038
	Contributed surplus (Note 1)	3,999,679	4,139,389
	Retained earnings	760,536	806,864
		4,871,253	5,057,291
		$7,185,769	$7,565,237

Nova Scotia Research Foundation Corporation
Consolidated Statement of Retained Earnings
for the Year Ended March 31, 1983

		1983	1982 Restated
	Balance, beginning of year	$ 806,864	$ 637,358
	Add: Excess (deficiency) of revenues over expenses	(46,328)	280,544
	Less: Transfer to Capital Equipment Reserve		111,038
	Balance, end of year	$ 760,536	$ 806,864

Nova Scotia Research Foundation Corporation
Consolidated Statement of Revenues and Expenses
for the Year Ended March 31, 1983

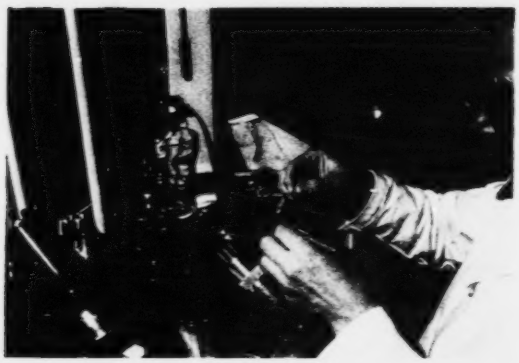
		1983	1982 Restated
Revenues	Scientific and engineering	$3,285,327	$3,761,377
	Grant from Province of Nova Scotia	1,824,000	1,600,000
		5,109,327	5,361,377
Expenses	Scientific and engineering	4,226,348	4,312,904
	Administrative and occupancy	1,153,891	1,069,040
		5,380,239	5,381,944
	Excess (deficiency) of revenues over expenses before investment income	(270,912)	(20,567)
Investment Income	Research Endowment Fund	92,973	82,500
	Short term investments	131,611	218,611
		224,584	301,111
	Excess (deficiency) of revenues over expenses	$ (46,328)	$ 280,544

Other Services & Administration

Glass Blowing

Glass Blowing services are provided for industry and research laboratories in Atlantic Canada. Repair of milking jugs, construction of vacuum distillation rigs,and repair or modification of laboratory glassware are a few examples of work undertaken.

Glassblower
R. Maxwell



The well-equipped shop works with the Corporation's scientists and engineers to produce prototypes for testing, evaluation, and modification. Further requirements for hardware are contracted out to local industry.

Shop Supervisor
C. E. Isenor

Machinists
A. B. Johnson
L. R. Hartlen
D. W. Haskins
R. A. Marks

Administration

President
J. E. Blanchard
B.Sc. (Dal.), M.A., Ph.D. (Tor.), F.R.S.C.

Vice-President
T. B. Nickerson
B.Eng. (Acadia, N.S.T.C.), M.Sc. (Birm.), P.Eng.

Secretary to the President
N. J. Gerogiannis

Consultants
R. H. Magarvey
B.Sc. (Acadia), M.Sc. (McGill), D.Sc. (Acadia)
H. D. Smith
B.A., M.A. (U.B.C.), M.A., Ph.D. (Tor.)
D.Sc. (Acadia, St. F.X.)
C. N. Kennedy
P. N. Taiani

Manager of Administration
R. F. MacNeill
B.Sc., B.Comm. (S.M.U.)

Secretary to Administration
S. J. Drover

Accounting
K. J. Hornsby
R. Chaffey
E. M. Marr
H. Pelton

Building Services
G. E. Fraser
J. F. Brown
M. Crawford
G. E. Dean
W. Jodrey
D. K. Julien
E.W.M.H. Maessen
L. J. Mannette
L. Merrigan
R. Reid
F. Walsh

Carpentry Shop
R. C. Fraser

Purchasing and Shipping
W. G. LeRue
J. M. Foster
J. Pelton

Support
B. Gandhu
B. Oldfield
J. Parent

POOR

QUALITY

ORIGINAL